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A Edward Scherer
Manager of Nuclear
Oversight and Regulatory Affairs

June 12, 2001

Mr. Ivan Kingsley
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215 Parkway North
Waterford, CT 06385

Subject: **Docket Nos. 50-361 and 50-362**
Comments on Answer Key for Generic Fundamentals Exam
San Onofre Nuclear Generating Station, Units 2 and 3

Reference: Letter, Mr. Glenn M. Tracy (NRC) to Mr. Wayne Lyke (SCE), "Generic Fundamentals Examination (GFE)," dated May 24, 2001

Gentlemen:

On June 6, 2001, the Generic Fundamentals Examination was administered at San Onofre with the exam results being transmitted to Sonalysts (via Fedex) on June 7, 2001. Sonalysts provided San Onofre with the exam answer key on June 8, 2001, and requested comments to be provided by June 13, 2001. The attachment to this letter provides the requested comments.

If you have any questions or require additional information, please contact Mr. Clay E. Williams at (949) 368-6707.

Sincerely,

Enclosure

cc: NRC Document Control Desk
Glenn M. Tracy, Chief, Operator Licensing, Human Performance and Support Branch

M003

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Sonalysts, Inc June 12, 2001

GFE EXAM ADMINISTERED 06/04/01

Examination Form A, Question #78:

A reactor plant is operating normally at 60% power when heating steam (supplied by the main steam system) to the moisture separator/reheaters (MSR) is isolated. The reactor plant is stabilized with heating steam still isolated.

Assuming that the steam flow rate (lbm/hr) through the main turbine is unchanged, what effects will the loss of MSR heating steam have on the steam plant?

A. *Main turbine efficiency will not change appreciably, but the high pressure element of the main turbine will be subjected to a significant increase in moisture impingement.*

B. *Main turbine efficiency will not change appreciably, but the low pressure elements of the main turbine will be subjected to a significant increase in moisture impingement.*

C. *Main turbine efficiency will decrease by several percent, and the high pressure element of the main turbine will be subjected to a significant increase in moisture impingement.*

D. *Main turbine efficiency will decrease by several percent, and the low pressure elements of the main turbine will be subjected to a significant increase in moisture impingement.*

<u>Discussion</u>:

The interim answer key identifies "D. *Main turbine efficiency will decrease by several percent, and the low pressure elements of the main turbine will be subjected to a significant increase in moisture impingement"* as the correct answer, and we concur this is a potentially correct choice.

It is the low pressure turbine elements rather than the high pressure turbine which will be subjected to significantly higher moisture impingement for the stated conditions. Therefore, choices *A.* and *C.* are clearly incorrect.

The question stem does not provide adequate information to either prove or disprove answer *B.* as a correct choice.

The loss of heating steam in the MSR will result in lower enthalpy steam entering the low pressure (LP) turbine elements. The LP turbine elements will extract less energy from this lower enthalpy steam, and will exhaust into the condenser with a lower quality (higher

moisture content). When compared to turbine performance prior to the loss of MSR heating steam, this reduction in energy extraction by the LP turbine elements could approach several percent. However, there is also less energy available for extraction by the LP turbines following the loss of MSR heating steam. Ratios of energy extracted vs. energy available could be calculated for assumed cases, but would be useful only to compare of ideal turbine performance for the two cases specified (i.e., with and without MSR heating steam).

Main turbine efficiency (i.e., how real turbine performance compares to performance of the ideal turbine for specific conditions) is a function of turbine design. Some turbines may be able to accept a relatively broad range of inlet conditions with little change in efficiency. Others may be designed for optimum performance at more limited and specific conditions (typically normal full power conditions) and efficiency may suffer more drastically if inlet conditions deviate from the design values. To determine postulated changes in turbine efficiency would require either the availability of substantial turbine design information or specific information regarding the actual inlet and exhaust parameters. Furthermore, if the subject turbine is designed for optimum performance at normal full power inlet steam conditions, then the performance of this turbine has most probably already degraded due to the stated existing conditions of only 60% power; and any further degradation in turbine efficiency is indeterminate from the information provided.

Conclusion:
Since neither turbine design information nor specific turbine inlet and exhaust conditions are provided, the magnitude of any change in main turbine efficiency cannot be determined using the information provided. It may be either minimal or significant, depending on turbine design. In either case, low pressure turbine exhaust quality will decrease (moisture content will increase) for the stated conditions. Therefore, both choices *B.* and *D.* should be considered acceptable for this question as written.